

## Environmentally Exposed Population to Mercury and Chronic Noncommunicable Diseases in the Lower Amazon: A Systematic Review

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### Citation

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## REVIEW TITLE AND BASIC DETAILS

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### Review title

Environmentally Exposed Population to Mercury and Chronic Noncommunicable Diseases in the Lower Amazon: A Systematic Review

### Original language title

População Ambientalmente Exposta ao Mercúrio e as Doenças Crônicas Não Transmissíveis, no Baixo Amazonas: Revisão Sistemática

### Review objectives

Population: Populations in the Brazilian Amazon exposed to mercury (Hg).

Intervention: Mercury exposure and its health consequences, especially in the context of Chronic Noncommunicable Diseases (NCDs) such as hypertension and diabetes.

Comparator: Not applicable, as there is no direct control group.

Outcome: Identification of the most prevalent NCDs and the populations most affected by mercury exposure, with the aim of providing informative support for public health interventions.

## SEARCHING AND SCREENING

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### Searches

The research will use sources such as PubMed, Scopus, Springer, Web of Science, PsycINFO and Proquest. Searches will be conducted for publications from 2019 to 2024, and only publications in English and Spanish will be included.

### Study design

Descriptive, explanatory, and experimental quantitative studies that examine the relationship between chronic mercury exposure and Chronic Non-Communicable Diseases (CNCDs) such as hypertension and diabetes in populations within the Brazilian Amazon.

## ELIGIBILITY CRITERIA

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### Condition or domain being studied

The condition being studied in this systematic review is the impact of chronic mercury exposure on the development and exacerbation of Chronic Non-Communicable Diseases (CNCDs), such as hypertension and diabetes mellitus, among populations in the Brazilian Amazon. These populations, particularly indigenous and riverine communities, are chronically exposed to mercury, primarily through the consumption of contaminated fish. The review aims to explore the relationship between this environmental exposure and the prevalence or severity of CNCDs, given the significant health burden these diseases represent. The study focuses on understanding how long-term exposure to mercury contributes to the risk and progression of these chronic diseases within vulnerable populations in the Amazon region.

### Population

The participants or populations being studied in this review are individuals from the Brazilian Amazon, specifically focusing on indigenous and riverine communities that are chronically exposed to mercury through environmental and dietary sources, primarily the consumption of contaminated fish.

Inclusion Criteria:

Individuals of any age or gender who reside in the Brazilian Amazon region.

Populations with documented exposure to mercury, particularly methylmercury.

Studies that report on the prevalence or impact of Chronic Non-Communicable Diseases (CNCDs), such as hypertension, diabetes mellitus, or cardiovascular diseases, in relation to mercury exposure.

Exclusion Criteria:

Populations from regions outside the Brazilian Amazon.

Studies focusing on acute rather than chronic mercury exposure.

Populations without documented or quantifiable exposure to mercury.

Studies that do not specifically address the relationship between mercury exposure and CNCDs.

Case reports, editorials, and studies with incomplete or non-accessible data.

### **Intervention(s) or exposure(s)**

The exposures being reviewed in this systematic study are related to chronic environmental exposure to mercury, particularly methylmercury, within the Brazilian Amazon population. This exposure primarily occurs through the consumption of contaminated fish, a common dietary practice in the region. The review focuses on understanding how prolonged exposure to mercury contributes to the development or exacerbation of Chronic Non-Communicable Diseases (CNCDs) such as hypertension, diabetes mellitus, and cardiovascular diseases.

### **Comparator(s) or control(s)**

not applicable

## **OUTCOMES TO BE ANALYSED**

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### **Main outcomes**

This systematic review focuses on understanding the relationship between chronic mercury exposure and the prevalence or exacerbation of Chronic Non-Communicable Diseases (CNCDs) in the Brazilian Amazon population. The primary outcome is the prevalence of CNCDs, including hypertension, diabetes mellitus, and cardiovascular diseases. This will be defined as the proportion of individuals diagnosed with these conditions, with data extracted from the studies and reported as a percentage or rate per 1, 000 or 100, 000 individuals. Diagnoses will follow clinical criteria established in the original research, such as specific blood pressure measurements for hypertension or blood glucose levels for diabetes. Another key outcome is the severity or progression of CNCDs in individuals exposed to mercury, assessed through clinical indicators like increased blood pressure, worsening glycemic control, or complications associated with these diseases. The studies may report these outcomes as relative risk, odds ratios, or hazard ratios, comparing mercury-exposed groups to those with minimal or no exposure. The review will also consider mercury levels in biological samples (blood, hair, urine), typically measured in micrograms per liter or gram, to correlate exposure levels with CNCD prevalence and severity. Measurements generally reflect chronic exposure over extended periods.

### **Additional outcomes**

The pre-specified additional outcomes of this review include health-related quality of life (HRQoL), healthcare utilization, and mortality rates among individuals exposed to mercury, particularly those with Chronic Non-Communicable Diseases (CNCDs). HRQoL will be assessed to understand the broader impact of chronic mercury exposure on the well-being of individuals diagnosed with CNCDs, focusing on physical, mental, and social dimensions. This outcome will be measured using validated HRQoL instruments, such as the SF-36 or EQ-5D, as reported in the studies included in the review. Another important outcome is healthcare utilization, which examines the frequency of healthcare services used by those exposed to mercury. This will include the number of hospital visits, admissions, or medical consultations related to CNCDs, providing insight into the healthcare burden associated with chronic mercury exposure. Additionally, the review will consider mortality rates among individuals exposed to mercury, particularly those with CNCDs, as a critical outcome. This will be measured as the number of deaths per 1, 000 or 100, 000 individuals within the studied population, aiming to identify any correlation between mercury exposure and an increased risk of mortality in CNCD patients. By examining these additional outcomes, the review seeks to provide a

comprehensive understanding of the broader impacts of chronic mercury exposure on vulnerable populations in the Brazilian Amazon.

## DATA COLLECTION PROCESS

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### **Data extraction (selection and coding)**

Studies will be selected for inclusion through a structured, multi-step process. Initially, all studies identified from database searches will be compiled, and duplicates will be removed using reference management software like Zotero. Two independent reviewers will then screen the titles and abstracts of the remaining studies to identify those that meet the inclusion criteria. Studies that do not meet the criteria will be excluded at this stage. For studies that appear relevant, full texts will be retrieved and independently reviewed by the same two reviewers to confirm their eligibility based on the predefined inclusion and exclusion criteria. Any disagreements between the reviewers will be resolved through discussion or by involving a third reviewer if necessary.

Data extraction will be conducted using a standardized data extraction form to ensure consistency and accuracy. The extracted data will include details such as study characteristics (e.g., author, publication year, study design), participant information (e.g., population, sample size, age, gender), exposure details (e.g., type and level of mercury exposure), and outcome measures (e.g., prevalence and severity of CNCs, health-related quality of life, healthcare utilization, mortality rates). Methodological aspects, such as statistical methods and potential sources of bias, will also be recorded.

The data extraction process will be carried out independently by two reviewers, with all data recorded in a spreadsheet or database. Any discrepancies in data extraction will be resolved through discussion between the reviewers. This systematic and thorough approach to study selection and data extraction will ensure that the review is comprehensive, reliable, and based on high-quality evidence.

### **Risk of bias (quality) assessment**

The characteristics of the studies that will be assessed include study design, sample size, population demographics (e.g., age, gender, ethnicity), type and level of mercury exposure, outcomes measured (e.g., prevalence and severity of CNCs, health-related quality of life, healthcare utilization, mortality rates), and statistical methods used. To assess the risk of bias and quality of the studies, formal tools will be utilized. For observational studies, the Newcastle-Ottawa Scale (NOS) will be applied, evaluating factors such as selection, comparability, and outcome ascertainment. For any randomized controlled trials included, the Cochrane Risk of Bias tool (RoB 2) will be used, assessing bias across domains like randomization, intervention deviations, and outcome measurement.

Two independent reviewers will conduct the risk of bias assessments, with any disagreements resolved through discussion or consultation with a third reviewer. The results will be documented and integrated into the analysis to ensure that the review's conclusions are based on high-quality, reliable evidence. This approach helps in identifying potential biases that could affect the validity of the findings.

## PLANNED DATA SYNTHESIS

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## Strategy for data synthesis

The data synthesis for this systematic review will focus on a descriptive synthesis of the included studies, summarizing key characteristics such as the types of Chronic Non-Communicable Diseases (CNCDs) examined, levels of mercury exposure, and population demographics. The synthesis will provide an overview of the evidence base, highlighting patterns and trends across the studies.

The findings will be presented in tables and narrative form, allowing for a clear comparison of results across different studies. Special attention will be given to identifying common themes and differences in how mercury exposure affects the prevalence and severity of CNCDs in the Brazilian Amazon population. Factors such as age, gender, and specific disease outcomes will be examined to understand better how different variables might influence the relationship between mercury exposure and health outcomes.

Given the expected variability across studies, the synthesis will focus on qualitative integration rather than statistical aggregation. The narrative synthesis will explore the direction and strength of the evidence, considering the quality and consistency of the studies. This approach will allow for a comprehensive understanding of the impact of chronic mercury exposure on CNCDs in the Brazilian Amazon, even in the absence of homogeneity that would allow for quantitative synthesis.

## Analysis of subgroups or subsets

not applicable

## REVIEW AFFILIATION, FUNDING AND PEER REVIEW

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### Review team members

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### Funding source

not applicable

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## TIMELINE OF THE REVIEW

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**Review timeline**

Start date: 30 August 2024. End date: 31 December 2024

**Date of first submission to PROSPERO**

18 August 2024

**Date of registration in PROSPERO**

29 August 2024

**CURRENT REVIEW STAGE**

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**Publication of review results**

The intention is not to publish the review once completed.

**Stage of the review at this submission**

Review stage	Started	Completed
Pilot work		
Formal searching/study identification		
Screening search results against inclusion criteria		
Data extraction or receipt of IP		
Risk of bias/quality assessment		
Data synthesis		

**Review status**

The review is currently planned or ongoing.

**ADDITIONAL INFORMATION**

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**PROSPERO version history**

- Version 1.1 published on 29 Aug 2024
- Version 1.0 published on 29 Aug 2024

**Review conflict of interest**

None known

**Country**

Brazil

**Medical Subject Headings**

Brazil; Chronic Disease; Control Groups; Diabetes Mellitus; Humans; Hypertension; Mercury; Noncommunicable Diseases; Public Health

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